Hydrologic and hydrogeochemical evolution of bedrock groundwaters in the Pungki Area

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An integrated study based on hydrochemical, thermodynamic, environmental isotopic and mass-balance approaches was performed for surface and ground waters in Precambrian gneiss of the Pungki area. Shallow (<70 m deep) groundwater belongs to the 'Ca-HCO3' type and have higher concentrations of Ca, Mg, SO4 and NO3, whereas deep groundwater (500-810 m) are the 'Na-HCO3' type with elevated concentrations of Na, Ba, Li, H2S, F and Cl. The qualty of deep groundwater was formed by the following reactions: 1) plagioclase dissolution and calcite precipitation, 2) sulfate reduction, and 3) hydrolysis of mica.

Environmental isotope data indicate that deep groundwater (tritium content = <0.2 TU) was recharged from distal mountain altitudes largely during pre-thermonuclear age and underwent deep circulation, whereas shallow groundwater (tritium content = 5.7-7.8 TU) was recharged recently from nearby low altitudes. Based on the δ34S values of dissolved sulfate, the enhanced amounts of dissolved H2S (up to 3.9 mg/l) in deep groundwater was probably derived from reduction of sulfate. The δ13C values of dissolved carbonates imply the dissolution of carbonate minerals by soil CO2 for shallow groundwater but the subsequent reprecipitation of calcite for deep groundwater. An integrated model of the hydrologic and hydrogeochemical evolution of groundwater is proposed.